

NUMBER SENSE

GRADES K-5

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MATH & SCIENCE COLLABORATIVE

AGENDA

- ⦿ Mental Math
- ⦿ Number Talks-Do these children have number sense? (videos)
- ⦿ What Is Number Sense?
- ⦿ Visual Models and Number Sense
- ⦿ Practice Facilitating Number Talks-Roleplay

MENTAL MATH

As you solve this problem,
think about the strategy that
you are using.

70-59

WHAT JUST HAPPENED?

- ⦿ How was what we just did different than what usually happens in math class when computation is performed?
- ⦿ What moves did you notice the facilitator doing?
- ⦿ What did you notice about how you felt as a learner?

WHAT IS A NUMBER TALK?

A Number Talk is a five to fifteen minute classroom conversation around **purposefully crafted computation** problems that are solved mentally...focused on making sense of mathematics.

- Sherry Parrish. *Number Talks*. 2010

ESSENTIAL COMPONENTS

1. Classroom Environment and Community
2. Classroom Discussions
3. Teacher's Role
4. Role of Mental Math
5. Purposeful Computation Problems

NUMBER SENSE

- Number sense is an awareness and understanding about what numbers are, their relationships, their magnitude, the relative effect of operating on numbers, including the use of mental mathematics and estimation

- Fennell and Landis (1987)

STUDENTS WITH NUMBER SENSE . .

- ◉ Naturally decompose numbers
- ◉ Can visualize quantities
- ◉ Develop and use benchmarks as referents
- ◉ Use the relationships among operations and their knowledge of the base-ten number system to solve problems
- ◉ Estimate a reasonable result for a problem
- ◉ Have a disposition to make sense of numbers, problems, and results

PLACE VALUE STANDARDS

- ◎ PA Core Standards talk about “strategies based on place-value, properties of operations, and/or relationships between operations.”
 - Look at the standards. What strategies are they focusing on? What are “strategies based on place-value, properties of operations, and/or relationships between operations.?”

2.OA.2

Add and subtract within 20.

2. Fluently add and subtract within 20 using mental strategies.² By end of Grade 2, know from memory all sums of two one-digit numbers.

²See standard 1.OA.6 for a list of mental strategies.





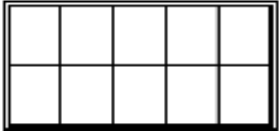
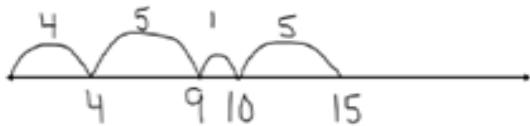
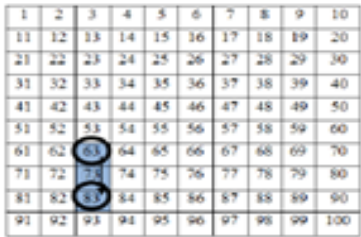
1.OA.6

6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$); decomposing a number leading to a ten (e.g., $13 - 4 = 13 - 3 - 1 = 10 - 1 = 9$); using the relationship between addition and subtraction (e.g., knowing that $8 + 4 = 12$, one knows $12 - 8 = 4$); and creating equivalent but easier or known sums (e.g., adding $6 + 7$ by creating the known equivalent $6 + 6 + 1 = 12 + 1 = 13$).

CONCEPTUAL UNDERSTANDING

- ◎ Understanding operations
 - Symbolic representations
 - Relationship between parts and whole
 - Investigating the meaning of facts through hands-on activities and thoughtful discussions
- ◎ Understanding is gained through:
 - Problem posing
 - Hands-on exploration
 - Classroom discussions
 - Real-world examples

VISUALS TO DEVELOP NUMBER SENSE: MODELS AND TOOLS

Dot images	
<u>Rekenreks</u>	 
Five- and ten-frames	 
Number line	Solving $4 + 5 + 6$ 
Hundred chart	<div>$63 + 10 = 73$ $73 + 10 = 83$</div> 

DEVELOPING NUMBER SENSE: VISUALS

- ◉ Develop students' understanding of a quantity
- ◉ Give numbers meaning
- ◉ Help students see the relationships of numbers to one another
- ◉ Helps students move from perceptual to conceptual subitizing
 - Children who can subitize perform better in mathematics in the long run (Butterworth).
- ◉ Support understanding of how numbers operate

RELATIONSHIPS AMONG NUMBERS

◉ Spatial Relationships

- Recognize sets of objects in patterned arrangements and tell how many without counting (subitizing)

◉ Benchmarks of 5 and 10

- Develop relationships for numbers

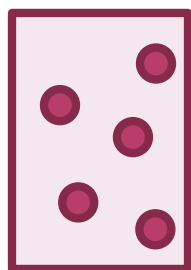


SPATIAL RELATIONSHIPS

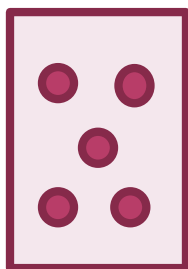
- Can you visualize the patterns children are likely to see on dice, cards, and dominoes?
- Dot Cards can help children:
 - Recognize sets of objects in patterned arrangements and tell how many without counting
 - Several common patterns for most numbers
 - Patterns can be made up of two or more easier patterns of smaller numbers
 - After 4 dots, students start to compose and decompose

DOT CARDS

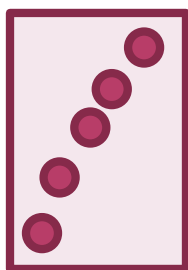
- ◉ Important factor in design of cards is arrangement of dots.
- ◉ Consider the dot cards below.
 - What mental strategies are likely to be prompted by each card?
 - What order would you place them in according to level of difficulty?



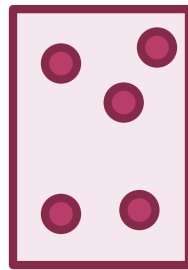
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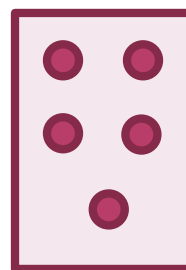
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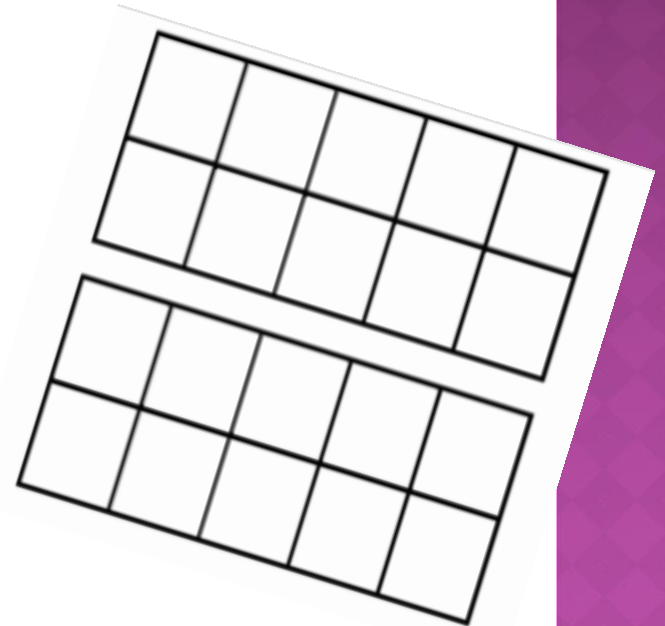
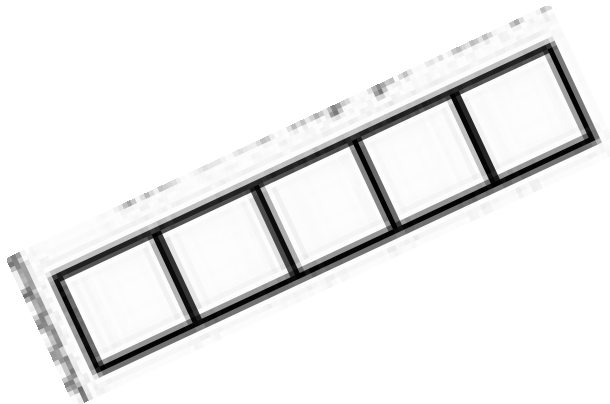
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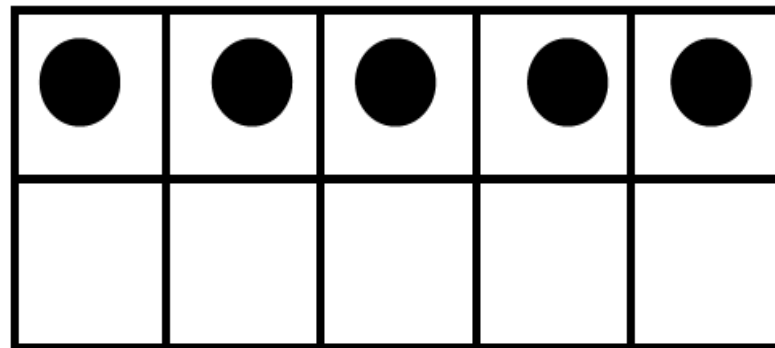
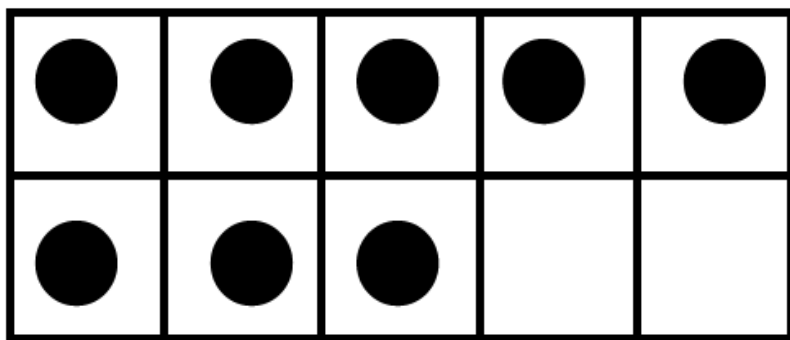
BECOMING FAMILIAR WITH 5- AND 10-FRAMES

- ◉ Use in classroom activities
- ◉ Use in classroom games

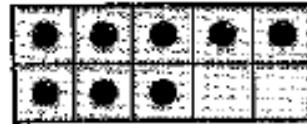


TEN FRAMES

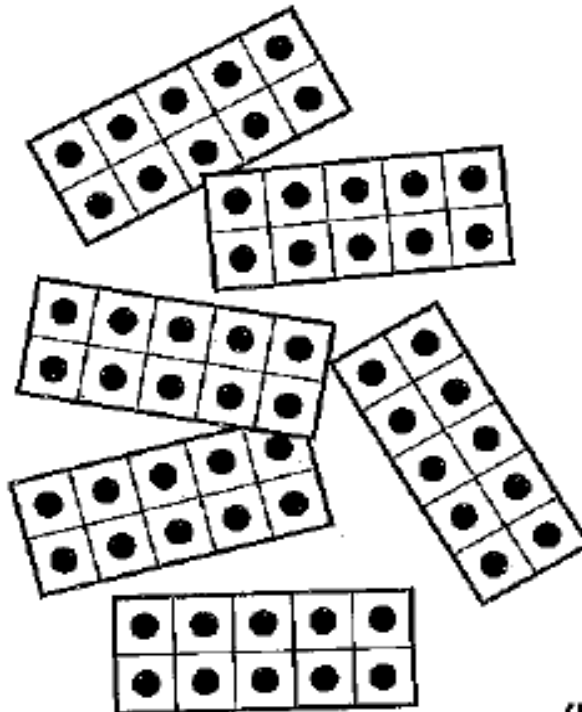
- ◉ Highlight use of 5- and 10-structures of our number system
- ◉ Frame shows quantity's relationship to 10
- ◉ Helps compose and decompose 10



EXTENDING TEN FRAME THINKING



8 and 5 more:
2 from 5 to get to 10
and 3 more is 13.

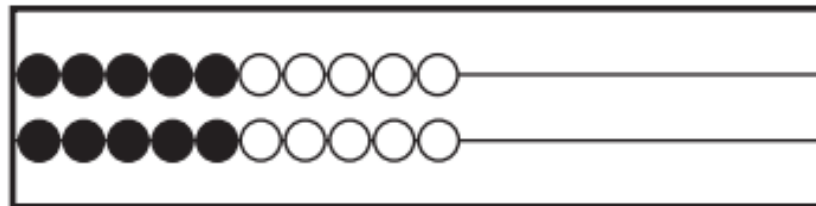


So ...
68 and 5:
2 more to
get to 70
and 3 is 73.



REKENREK (BEAD CARD)

- ◉ Dot cards encourage students to form mental images that they can use in determining the number in a set without counting: it fosters the development of thinking strategies. As students move beads, they are aware that each color is a set of five and each row is a set of ten.



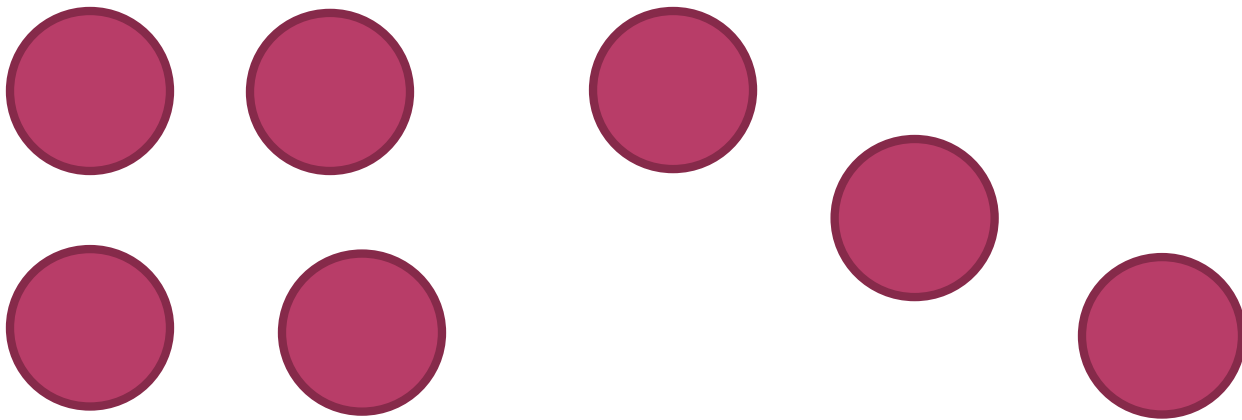
STRUCTURE OF TEN-FRAME AND BEAD CARD

When using ten frames or bead cards, students do not see a doubles structure, a ten structure, or a five structure. Those structures will need to arise in child's activity with the ten frame or bead card.

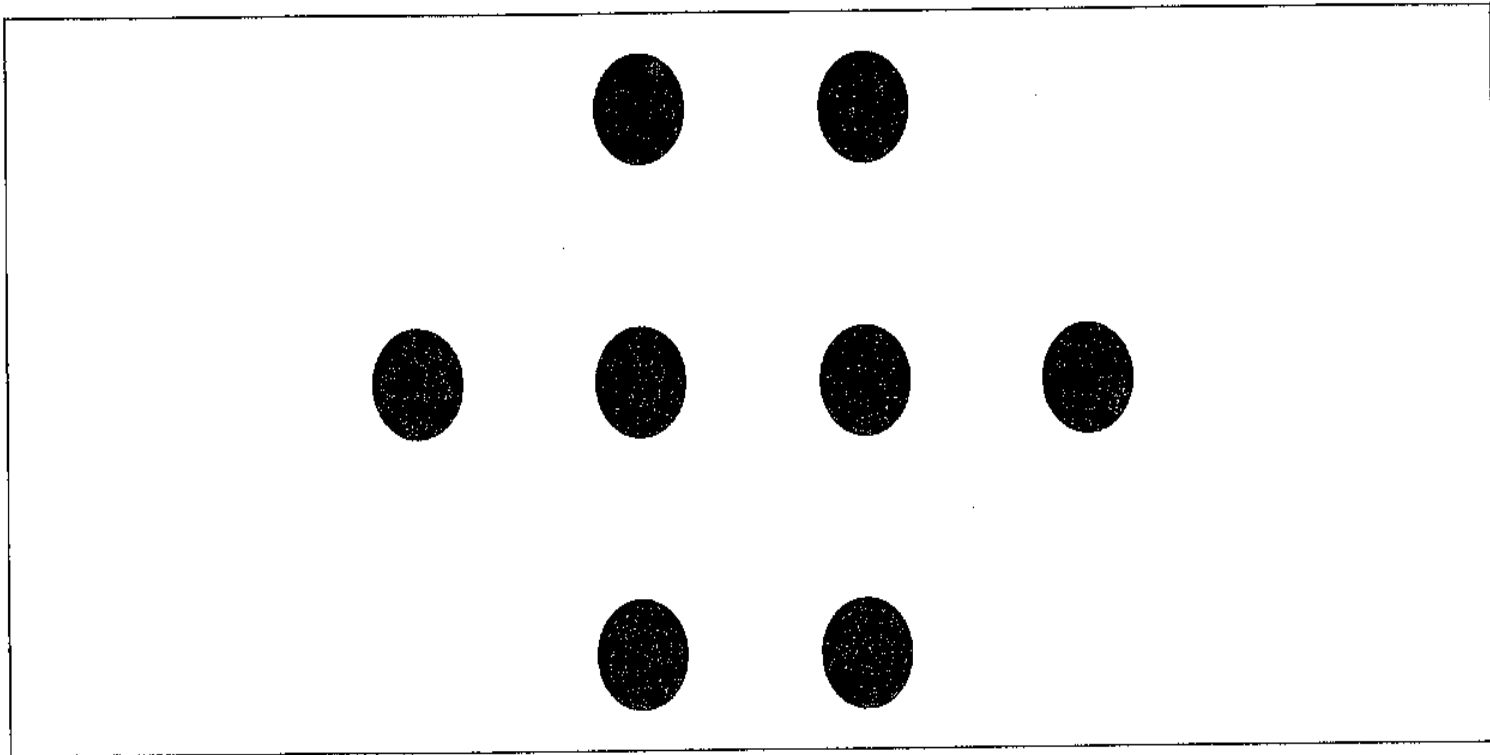
Put the models in context helps, e.g., bunk beds, double decker bus, parking lot

QUICK IMAGES

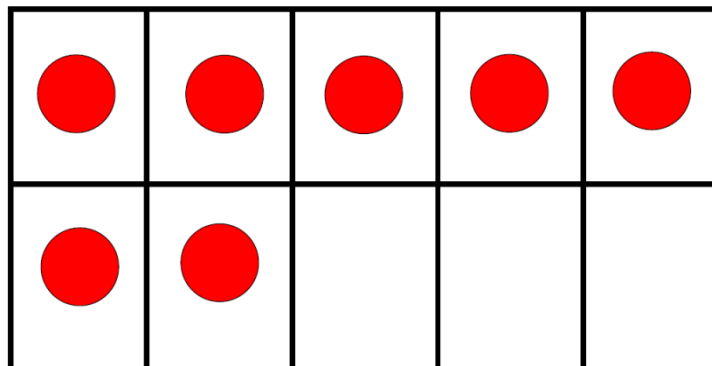
- ◉ Use a variety of models and visual arrangements
- ◉ Have students construct image, especially at first, and discuss their strategy
- ◉ Allows students to see math ideas within a mixture of formats
- ◉ Helps students think flexibly and encourages deep understanding of subitizing
- ◉ Show the images in a related order



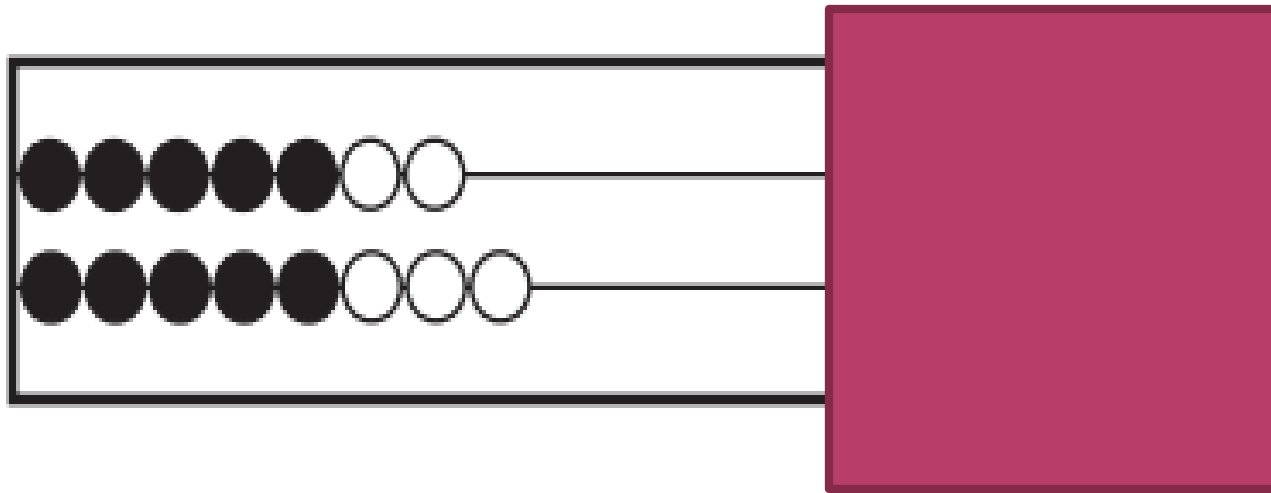
DOT CARDS



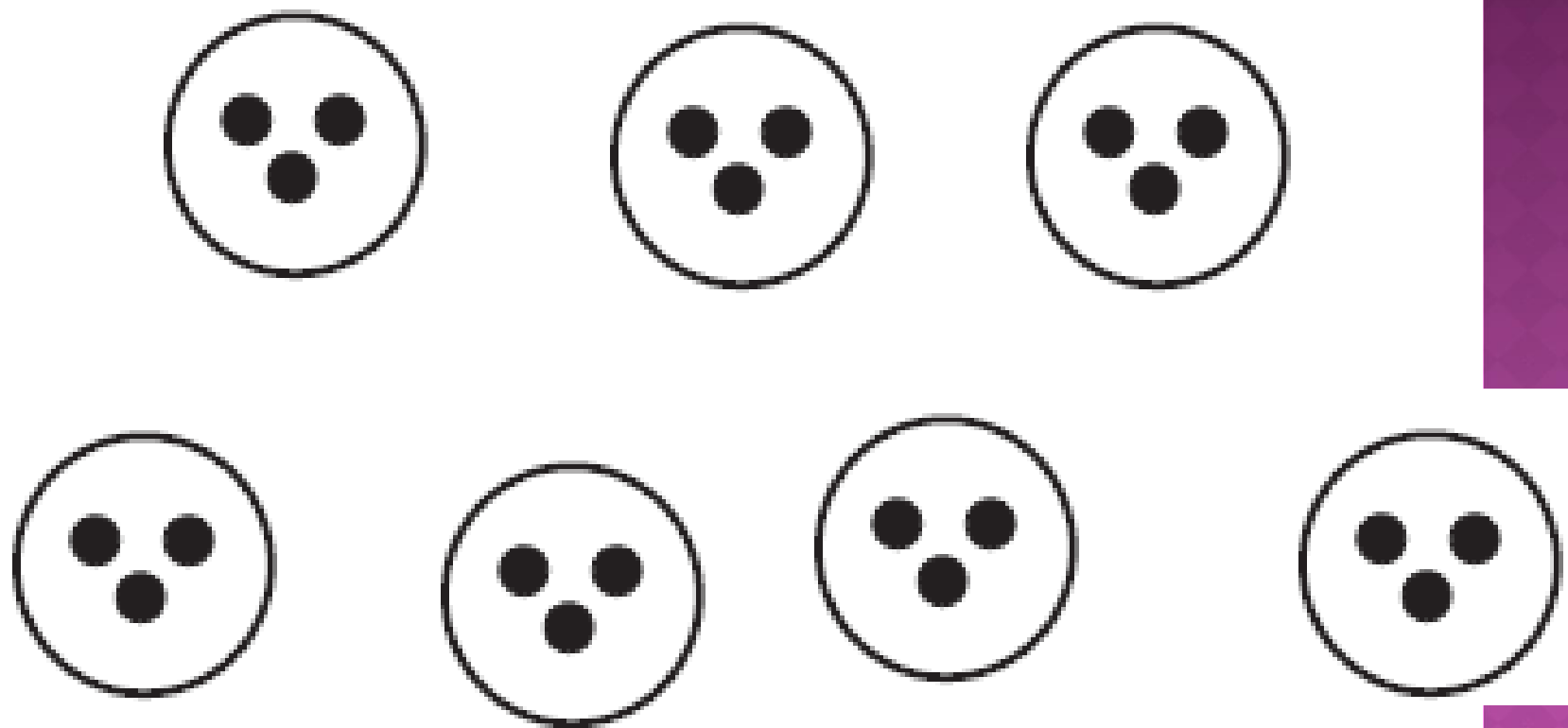
TEN FRAMES

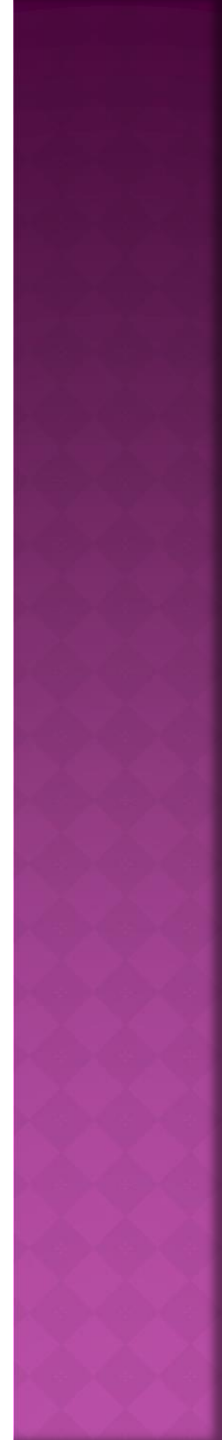
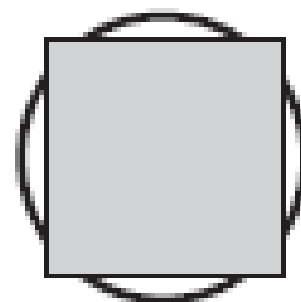
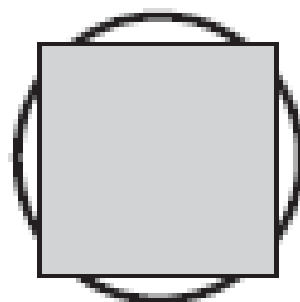
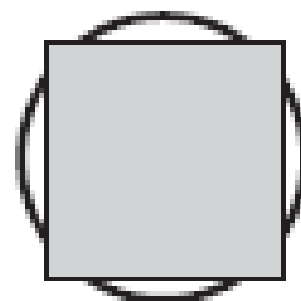
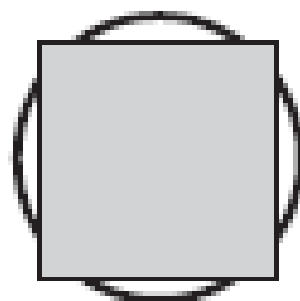
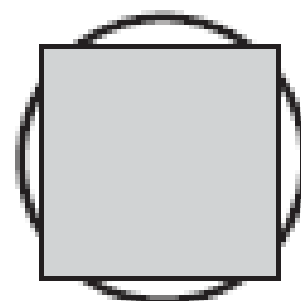
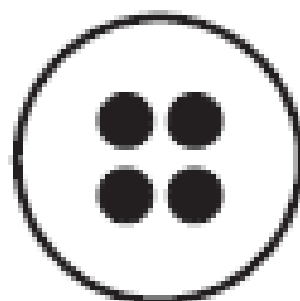


REKENREK (BEAD CARD)

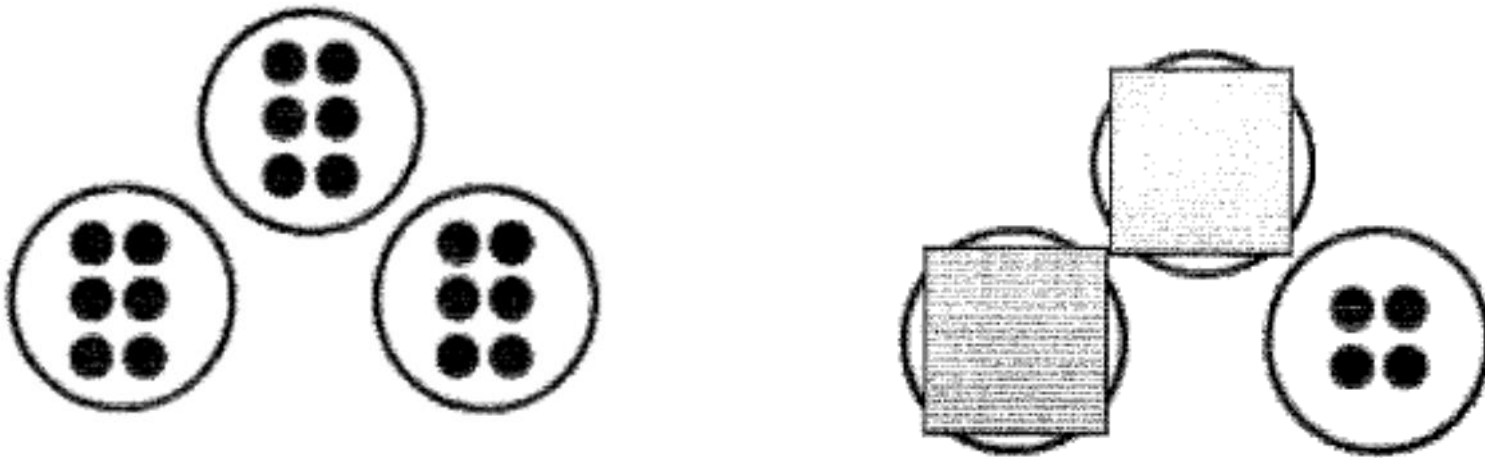


What prior knowledge do kids need here?





HOW ARE THESE CARDS DIFFERENT?



Review the cards with your table partners. Where might you begin with 3rd grade? 4th or 5th grade? When do you introduce the “covered” cards? How might you sequence the cards to build conceptual understanding?

SIMILARITIES & DIFFERENCES

- ◎ Think about the dots, the ten-frame, and the bead cards. What was the same and what was different about the representations?

STRATEGIES TO BUILD NUMBER SENSE

- ◉ Model different methods for computing.
- ◉ Ask students regularly to calculate mentally.
- ◉ Have class discussions about strategies for computing.
- ◉ Make estimation an integral part of computing.
- ◉ Question students about how they reason numerically.
- ◉ Pose numerical problems that have more than one possible answer.
- ◉ Pose real-life problems.
- ◉ Have students use visual models.

VARIATIONS ON QUICK IMAGES ROUTINE:

- ◉ Ask students to use manipulatives to re-create what they saw.
- ◉ Show several cards that all but one show the same number. Children are to determine which card does not match.
- ◉ Ask students to name the number that is one or two more or less than the quantity shown.

VIDEO: $8 + 6$ (2ND GR VIDEO. 1ST GR CCSSM)

- ◉ What are examples of how the ten-frame model supports student strategies for $8 + 6$?
- ◉ How does the ten-frame encourage students' understanding of 10 as an important number in computation?
- ◉ What seems to be a core strategy throughout this number talk?
- ◉ $8 + 6$ is considered to be a basic addition fact. What role can number talks play in helping students build basic fact knowledge?

QUICK IMAGES VIDEO- MIKE FLYNN

[HTTP://WWW.HEINEMANN.COM/EBOOKS/MY_KIDS_CAN.ASPX](http://www.heinemann.com/ebooks/my_kids_can.aspx)

- ◉ How does the teacher try to make the mathematics of the lesson explicit?
- ◉ How does he structure this activity?
- ◉ What decisions and moves does the teacher make?
- ◉ What questions does he ask?
- ◉ What statements does he make?

DO THESE STUDENTS HAVE NUMBER SENSE?

K2 - rekenreks

- ◉ How does the warm-up with four and six provide the teacher with information to guide her instructional decisions?
- ◉ What examples of one-to-one correspondence and conservation of number surface in the lesson?
- ◉ Are there specific number combinations that seem more accessible to students? How does the teacher build on this foundation?
- ◉ How does the rekenrek support students' in developing number sense?
- ◉ What evidence did you find of the students engaging in the Standards for Mathematical Practice?
- ◉ How does what you saw in the video connect to what you read about in the progression?

WHY HAVE STUDENTS TALK IN MATH CLASS?

- ◉ Talk can reveal understanding and misunderstanding
- ◉ Supports robust learning by boosting memory
- ◉ Supports deeper reasoning
- ◉ Supports language development
- ◉ Supports development of social skills

WHY HAVE STUDENTS TALK IN MATH CLASS?

- ◉ Can be a good form of *formative assessment* (assessment for learning) for you
- ◉ Can increase students' metacognitive abilities (thinking about how they think)
- ◉ Memory enhanced by the social significance of student-to-student dialogue
- ◉ Can even teach patience and acceptance of others and their ideas

LEADING A NUMBER TALK

- ◉ In your **expert group**, plan your assigned number talk. (~10 min)
 - Use the Planning Sheet provided to record your ideas.
 - Review the “featured” strategy on your card. Be prepared to introduce this strategy if none of your “students” share it.
 - How will you introduce it? What questions will you ask?

TAKE TURNS “LEADING” YOUR NUMBER TALK.

15 minutes per Number Talk + 5 minute Debrief

- ◉ Record “student thinking” on the poster paper. Consider the use of different colors, different representations-(i.e. number lines, area models, etc.)
- ◉ Press “students” to explain why their strategy makes sense to them.
- ◉ Ask “How else could we think about this?” Or, “Who thought of it differently?”
- ◉ What other questions will you ask to help the students make connections or better own a strategy?
- ◉ If no “student” shares the featured strategy on your card, introduce this strategy to the “class”.

5 minutes- Debrief the Number Talk. Use the guide sheet provided.

EXPERT GROUP POSTER REVIEW

- ◉ Review all the posters created by your expert group team members for your assigned Number Talk.
- ◉ What strategy(ies) seemed most common? Did the “featured” strategy arise from a student or from the teacher?
- ◉ Is it clear to tell where one strategy ends and another begins? Was it clear to follow?

WHOLE GROUP DEBRIEF

- ◉ Why should you plan a Number Talk? What were the benefits to planning your Number Talk?
- ◉ Why is it important to consider how and where to record student thinking during the Number Talk? (i.e. poster paper vs. smartboard vs. document camera, etc.)
- ◉ How do you make sure all students are involved, over time? How do you get them to enter into the discussion? (read pp. 159-162 of the *Number Sense Routines* book)

STANDARDS OF MATH PRACTICE

- ◉ How does a Number Talk engage students in the SMPs?
- ◉ Which SMPs are most prominently on display when students participate fully in a Number Talk? What is your evidence?

MAKING SENSE

“A child who expects things to ‘make sense’ looks for the sense in things. A child that does not see patterns often does not expect things to make sense and sees all events as discrete, separate, and unrelated”

(Burns 1984)

“THE HAVING OF WONDERFUL IDEAS”

“The wonderful ideas that I refer to need not necessarily look wonderful to the outside world. I see no difference in the kind between wonderful ideas that many other people have already had, and wonderful ideas that nobody has yet happened upon...The more we help children to have their wonderful ideas and feel good about themselves for having them, the more likely it is that they will someday happen upon wonderful ideas that no one else has happened upon before.

(Eleanor Duckworth, 1987)

RESOURCES FOR NUMBER TALKS

- ⦿ http://www.mathperspectives.com/num_talks.html Making Number Talks Matter.
- ⦿ http://www.heinemann.com/ebooks/my_kids_can.aspx My Kids Can
- ⦿ <https://www.youcubed.org/category/teaching-ideas/number-sense/> Jo Boaler at Youcubed
- ⦿ www.mscsummercourses2013.wikispaces.com go to the Number Sense page

THANK YOU

◎ The AIU Math & Science Collaborative

For more opportunities to dig deeper into the PA Core math standards, visit [Eventbrite.com](https://www.eventbrite.com) and search “*AIU MSC*” for all teacher networks offered by MSC.

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